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Wholesale pricing and local exchange competition

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Pricing, Exchange, Telecommunication, United States of America

Abstract

Examines recent trends in local exchange competition in the US telecommunications industry. Shows that the predominant modes of operation by competitive local exchange carriers (CLECs) have been changing over time. These operating modes also vary substantially in different regions of the country. Provides a preliminary exploration of the role of potential profit in explaining the extent of overall CLEC activity. Also considers the role of prices in explaining variation in CLEC operating mode, and discuss possible additional determinants of CLEC activity that merit further investigation.

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1. Introduction

Competitors have increased their supply of local telecommunications exchange services[1] substantially in the USA during the last several years, due in large part to the Telecommunications Act of 1996 (the Act)[2]. The Act requires incumbent local exchange carriers (ILECs) to make their network services and facilities available to competitive local exchange carriers (CLECs). In doing so, the Act enables CLECs to serve customers without building their own facilities, either by reselling ILEC services in their entirety or by employing components of ILEC networks, called unbundled network elements (UNEs). Under resale, a CLEC purchases (at a wholesale discount) the retail services supplied by an ILEC, and then re-sells these services to its retail customers using its own brand name. Under the UNE approach, a CLEC leases components of an ILEC's physical network (e.g. a loop and/or a switch) in order to deliver retail service to customers. CLECs may lease all of the UNEs needed to deliver a service (i.e. use the UNEs as a platform for delivering services; referred to as the UNE-Platform, or UNE-P). Alternatively, a CLEC may lease only selected UNEs, and combine these UNEs with its own facilities. Under this approach, a CLEC often combines its own switches with leased ILEC loops to deliver switched access service to customers. This approach is referred to as UNE-Loop, or UNE-L.

CLECs also can, and do, serve customers using their own facilities exclusively. As a general rule, CLECs tend to employ their own facilities in metropolitan areas to serve large business customers that demand high-capacity circuits. In contrast, many CLECs lease circuits from ILECs to serve mass market (i.e. small business and residential) customers in less dense areas. Even in these mass markets, though, some competitors employ their own facilities to supply telecommunications services, including wireline services, wireless telephony, telephone service delivered over cable television facilities, and, most recently, voice telephony provided via Internet protocol (i.e. voice over Internet protocol or VOIP).

Many policymakers believe that meaningful product differentiation and innovation in the telecommunications industry will be more fully realized when ILECs and CLECs invest in new facilities and deploy new technologies[3]. Thus, it

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is important for policymakers to understand the nature, as well as the extent, of competition in the local exchange[4], and to identify the primary determinants of CLEC activity.

In this paper, we review recent trends in the extent and nature of local exchange competition in the USA. In addition, we present some preliminary evidence regarding the relationship between the nature and extent of industry competition and regulated prices. The preliminary evidence includes a statistically significant association between the potential profit margins afforded by UNE prices and aggregate CLEC activity[5]. We also identify a corresponding association between relative UNE prices and the mode of CLEC operation.

In Section 2, we review recent aggregate CLEC activity and explore the components of this activity. Section 3 examines the extent to which recent CLEC activity varies across RBOC regions. Section 4 reviews the recent variation in local retail service prices and UNE prices, and corresponding potential profit margins. Section 5 presents a preliminary investigation of the extent to which the observed variation in CLEC activity might be explained by variations in profit margins. In Section 6 we consider the extent to which the nature of CLEC activity is influenced by relative UNE prices, and in Section 7 we provide concluding observations.

2. Nation-wide CLEC activity

Figure 1 summarizes CLEC activity in the USA during the past four years (from the first quarter of 2000 through the last quarter of 2003). The figure reveals that CLECs served just under 6 percent of the switched access lines in the USA at the beginning of 2000. By the end of 2003, the CLEC share of switched access lines had more than doubled, to approximately 16 percent[6].

Figure 1 also summarizes the components of this overall increase in CLEC share of access lines. Three primary trends are apparent. First, the fraction of CLEC access lines that represent resale competition has declined substantially over time. Resold lines accounted for approximately 42 percent of CLEC lines in the first quarter of 2000. By the fourth quarter of 2003, this number had declined to about 6 percent. Second, the fraction of CLEC lines that are UNE-P lines has increased substantially over time. Whereas only about 11 percent of CLEC access lines were UNE-P lines at the beginning of 2000, the corresponding fraction exceeded 55 percent at the end of 2003. Third, the fraction of CLEC lines that are UNE-L lines has increased slightly over time. UNE-L lines represented approximately 13 percent of CLEC access lines at the beginning of 2000, and approximately 15 percent at the end of 2003.

Resale and UNE-P are largely similar services. Both involve essentially the exclusive use of ILEC facilities to deliver final services to retail customers. However, the financial returns to the CLEC from using resale versus UNE-P lines typically differ. The regulated rates at which CLECs can purchase ILEC services for resale purposes reflect ILEC retail rates, reduced by a wholesale discount. Wholesale discounts are frequently less than the discount between retail prices and the rates for UNE-P[7]. In such cases, CLECs can secure higher profit margins under UNE-P than under resale. This fact may explain the pronounced reduction in resale reflected in Figure 1.

Figure 1 also reveals that the fraction of CLEC access lines that represent facilities-based competition has declined substantially over time. Facilities-based lines accounted for approximately 34 percent of total CLEC access lines at the beginning of 2000. By the end of 2003, facilities-based lines were estimated to account for only about 24 percent of CLEC access lines[8,9]. Of course, as noted above, these estimates likely understate the extent of facilities-based competition, especially with respect to the large business sector and in urban areas. Many CLECs have installed fiber-optic facilities in metropolitan areas and around corporate campuses to serve large customers, but are not required to report these activities to regulators.

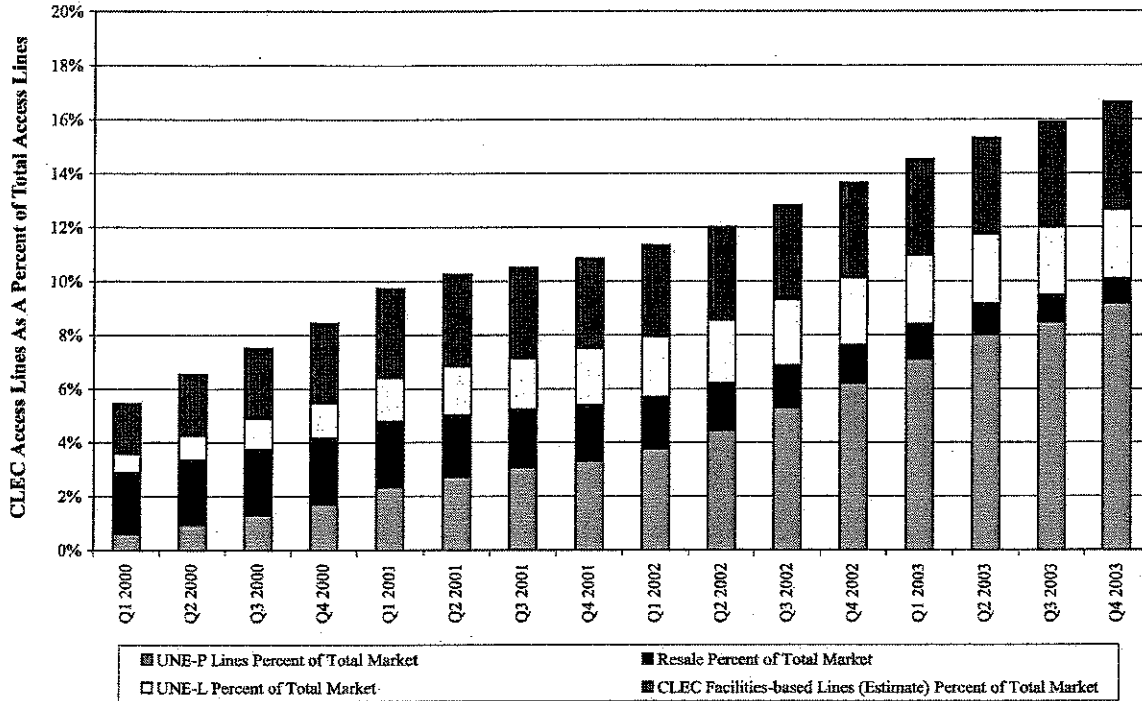
3. Differences in CLEC activity across RBOC territories

Figure 2 reveals the extent to which the nationwide trends depicted in Figure 1 vary across RBOC territories. Four primary conclusions are apparent.

First, the CLEC share of switched access lines is most pronounced and generally increasing most rapidly in SBC's operating territory. By the end of 2003, the CLECs served more than 20 percent of the switched access lines in SBC's operating territory (or "footprint"). In contrast, CLECs served approximately 15 percent of the access lines in BellSouth's footprint and in Verizon's footprint, and approximately 10 percent of the access lines in the footprint of Qwest.

Second, two of the nationwide trends depicted in Figure 1 appear in all four RBOC operating territories. In particular, resale access lines as a fraction of total access lines have declined dramatically since the beginning of 2000 in all territories. Also, CLEC access lines are predominantly UNE-P lines in all territories. UNE-P lines have increased more than five-fold since the beginning of 2000 in all regions other than the Qwest footprint, with the most pronounced growth occurring in the SBC and

Figure 1 CLEC share of local switched access lines in the USA



BellSouth footprints (more than 2,500 percent and 10,000 percent, respectively).

Third, as a fraction of total CLEC lines, facilities-based CLEC lines are most pronounced in the SBC and BellSouth footprints and least pronounced in Qwest's footprint. At the end of 2003, facilities-based access lines accounted for 25 percent of CLEC access lines in SBC's footprint, 24 percent in BellSouth's footprint, 22 percent in Verizon's footprint, and less than 20 percent in Qwest's footprint.

Fourth, the growth in CLEC UNE-L access lines has been least pronounced in the BellSouth footprint. Between the first quarter of 2000 and the last quarter of 2003, CLEC UNE-L access lines increased from approximately 0.6 percent to 1.3 percent of total switched access lines in the BellSouth footprint (approximately a two-fold increase). In the other RBOC operating territories, the corresponding increase in the percentage of CLEC UNE-L lines was more than five-fold, on average. As a fraction of CLEC access lines in the BellSouth footprint, UNE-L lines declined from 11.8 percent at the beginning of 2000 to 8.8 percent at the end of 2003.

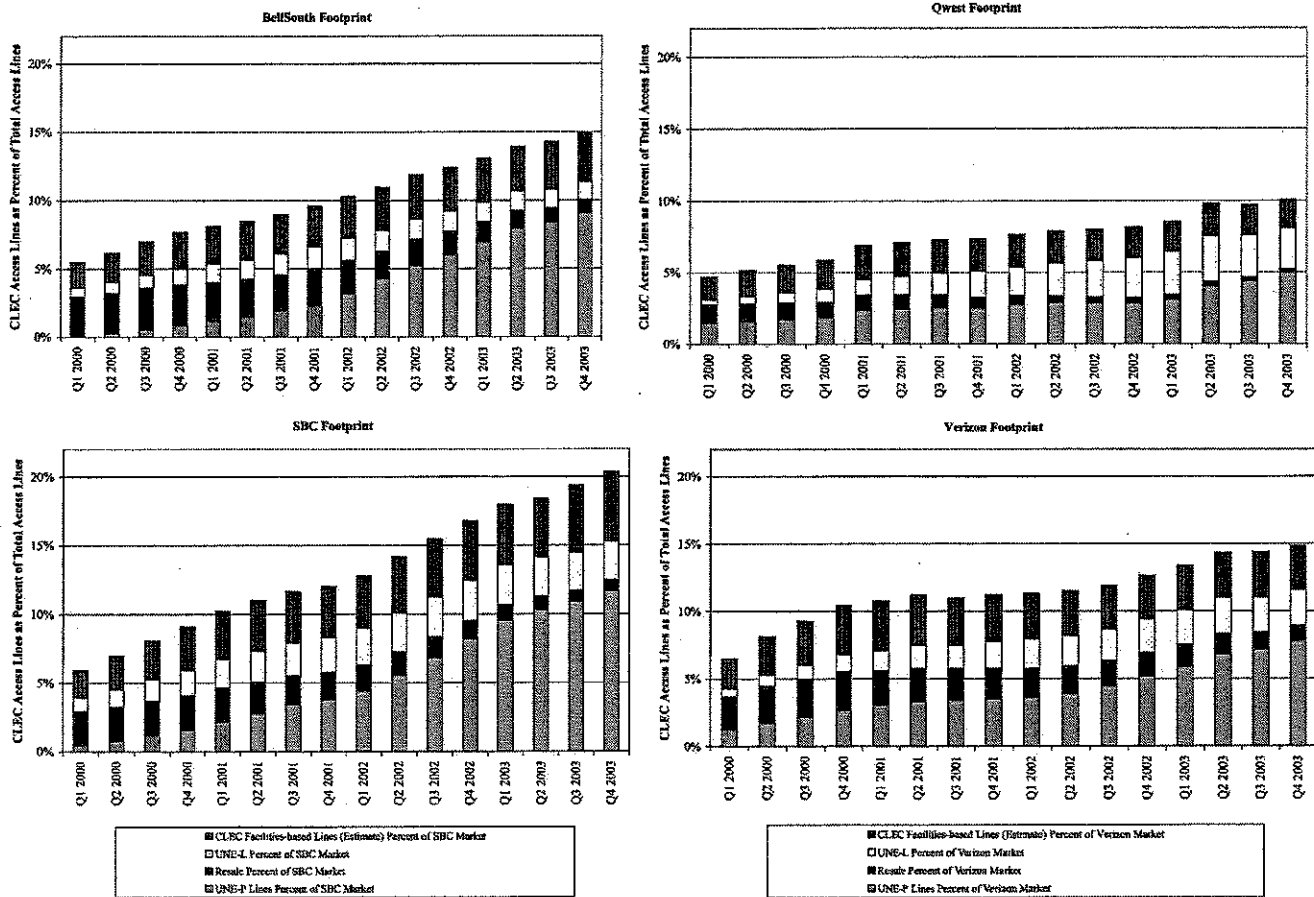
4. UNE prices and potential profit margins

The observed variation in CLEC activity across geographic regions likely is caused by many

factors, including the expected profitability of CLEC operations. One simple measure of the potential profitability of CLEC operations in a given state is the difference between the price the RBOC charges for various local exchange services in a state and the price a CLEC must pay to lease UNEs to offer those same services in that state, expressed as a percentage of the UNE price[10]. To construct this measure of potential profitability, we used the average revenue (per line per month) in a state, as provided by RBOCs, as a proxy for the price the RBOC charges for local exchange service[11,12]. We used the sum of monthly UNE-P loop, port, and switching rates in a state as a proxy for the state's UNE price[13]. In most instances, UNE-P and UNE-L loop rates are identical. However, in recent time periods, the UNE-L loop rate has exceeded the UNE-P loop rate in the nine states in BellSouth's footprint.

Figure 3 illustrates this simple measure of the potential profitability of CLEC operations across RBOC footprints between April 2001 and July 2003[14]. Three aspects of potential profitability are apparent. First, potential profitability has increased substantially in all RBOC footprints over time. Between 2001 and 2003, this measure of potential profitability increased from approximately 45 percent to approximately 85 percent, on average. This increase has stemmed

Figure 2 CLEC share of local switched access lines in RBOC footprints



almost entirely from reductions in UNE prices; the average revenue earned by the RBOCs changed very little during this period[15]. Second, potential profitability was highest in the SBC footprint and lowest in the Qwest footprint in 2003. Third, potential profitability has consistently been lowest in the Qwest footprint since 2001.

5. The role of prices in explaining aggregate CLEC activity

The measure of potential profitability depicted in Figure 3 does not capture all relevant determinants of the profit a CLEC would expect to earn. Nevertheless, to gain some insight regarding the determinants of CLEC activity, it is instructive to consider the extent to which aggregate CLEC activity is associated with this simple measure of potential profitability.

We employed a regression analysis to examine this association. Specifically, we regressed the

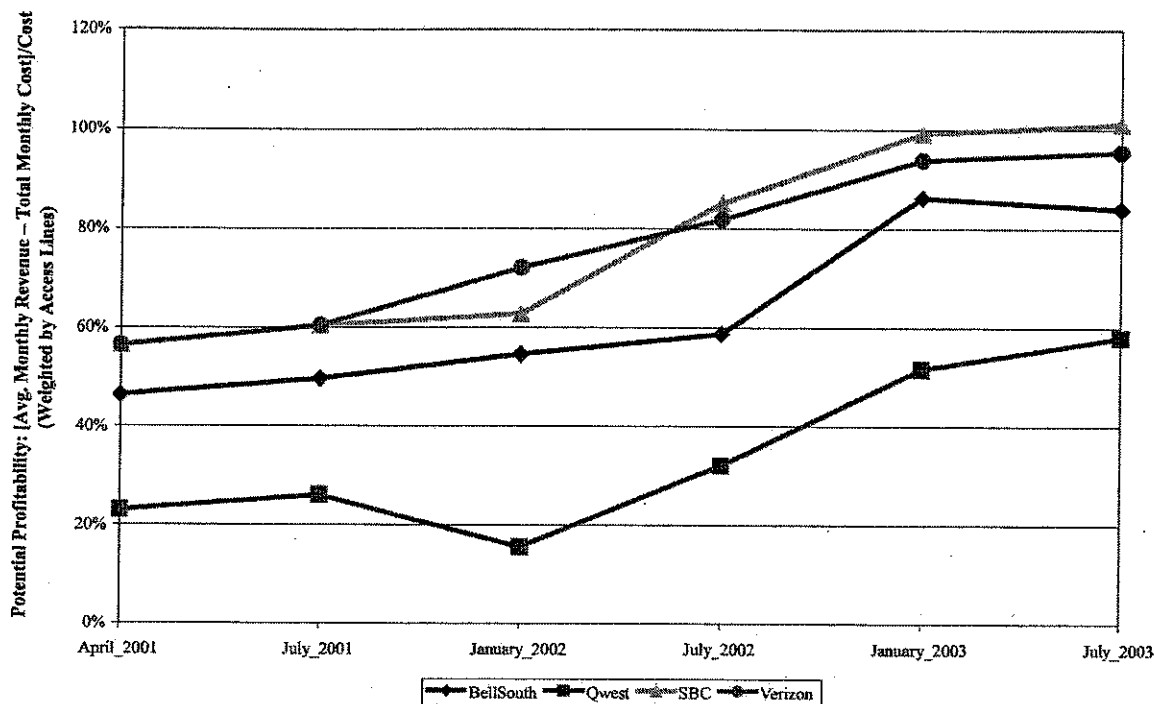
number of CLEC switched access lines in a state [C Lines] (in thousands)[16] on:

- our proxy for potential profitability (Prof);
- state population (Pop (in thousands))[17];
- RBOC-specific dummy variables (Q , S , and V)[18]; and
- a time trend variable (T)[19].

State population is included in the regression as a proxy for the number of potential customers. The RBOC dummy variables are included to control for unmeasured factors that may vary across RBOC footprints, but not over time[20]. The time trend variable is included to control for unmeasured effects that vary over time, but affect all jurisdictions symmetrically[21].

The regression results are summarized in equation (1)[22]. The numbers in parentheses below the coefficient estimates are t -values. The t -values indicate that all coefficient estimates other than that on the SBC dummy variable are significant at conventional confidence levels[23]:

Figure 3 potential profitability by RBOC footprint



$$\begin{aligned}
 \text{C LINES} = & -45615 + 340.1 T \\
 & (-7.38) \quad (2.59) \\
 & + 10.62 \text{ PROF} \\
 & \quad (3.55) \\
 & + 0.94 \text{ POP} \\
 & \quad (29.90) \\
 & + 2295 Q \\
 & \quad (4.08) \\
 & + 854 S \\
 & \quad (1.53) \\
 & + 3233 V \\
 & \quad (5.90)
 \end{aligned} \tag{1}$$

Equation (1) provides four primary observations[24]. First, potential profitability is indeed associated with an increase in CLEC access lines in a state during our sample period. A one percentage point increase in our measure of potential profitability is associated with an increase of more than 10,000 CLEC switched access lines in a state, after controlling for time, population, and regional effects. Second, the number of CLEC lines increases almost proportionately with the state population in our sample, suggesting that market size may be an important consideration for CLECs in targeting areas of deployment. Third, as Figures 1 and 2 indicate, CLEC access lines increase significantly during our sample period. Fourth, after controlling for population and potential profitability, CLEC activity is more pronounced in

the Qwest and Verizon footprints than in the BellSouth footprint during our sample period[25].

6. The role of relative UNE prices in explaining the mode of CLEC activity

As discussed in Section 3, the form of CLEC activity varies considerably across RBOC territories. A question of interest is whether this variation in the form of CLEC activity is influenced by relative UNE prices. To provide some preliminary evidence on this matter, we regressed the ratio of UNE-L to UNE-P CLEC access lines for an RBOC ([L/P Lines]) on the corresponding ratio of UNE-L to UNE-P loop prices in the RBOC footprint ([L/P Prices])[26]. The results of this simple regression, based on 20 observations for the period July 2001 through July 2003, are presented in equation (2):

$$\begin{aligned}
 \text{L/P Lines} &= -4.717 - 4.11 \text{ [L/P Prices]} \\
 &= (2.85) \quad (-2.51)
 \end{aligned} \tag{2}$$

Equation (2) indicates that a unit increase in the ratio of UNE-L to UNE-P prices is associated with a four-fold decrease in the ratio of UNE-L to

UNE-P CLEC access lines. This estimated decrease is statistically significant at conventional significance levels. Taken together, equations (1) and (2) suggest that UNE prices may influence both the nature and the extent of CLEC activity in the US telecommunications industry[27].

7. Conclusions

We have reviewed the patterns of recent CLEC activity across states and across RBOC operating territories, and have found that resale competition has declined substantially while UNE-P competition has increased considerably in recent years. We have also presented preliminary evidence, which suggests that retail prices and UNE prices (and associated profit margins) may play a significant role in determining both the nature and the extent of CLEC activity in the USA telecommunications industry. If this is the case, then both the retail prices and the UNE prices that regulators set are important determinants of industry competition.

Clearly, many factors other than contemporaneous prices and profit margins might affect the scale and form of CLEC activity in a state. These factors include:

- anticipated general economic activity (e.g. housing starts, employment, and personal income);
- the extent and nature of business activity;
- customer satisfaction with the incumbent supplier of local exchange services; and
- related telecommunications policies and regulatory orders (concerning, for example, the availability of UNEs).

Explicit controls for these factors and others will facilitate a more complete assessment of the determinants of CLEC activity[28].

Notes

- 1 Telecommunications services can be divided into three broad categories: local wireline service, mobile (or wireless) service, and toll wireline service. In 2001, total revenues in the US telecommunications industry were \$301.8 billion. Local wireline service revenues accounted for 42 percent of this amount, while mobile service and wireline toll service accounted for 25 percent and 33 percent, respectively. Local exchange service accounted for 57 percent of local service revenues (Federal Communications Commission, 2003a, Tables 15.1 and 15.2).
- 2 Pub. l. no. 104-104, 110 stat. 56 (codified at 47 u.s.c. §§ 151 *et seq.*).
- 3 See, for example, Federal Communications Commission (2003b).
- 4 While it is an important form of competition, local exchange competition between wireline-based CLECs and ILECs is just one piece of the intricate competition puzzle in the telecommunications industry. Wireless and wireline providers compete for the loyalty of some customers, for example (see Rodini *et al.*, 2003). Voice telephone service provided via cable is also competing for customers and, in the near future, VOIP will provide additional competition. Furthermore, many customers are substituting DSL and cable modem service for a second access line to their home.
- 5 See Jamison (2003), for example, for an earlier analysis of the effects of UNE prices on CLEC entry.
- 6 These estimates are based on data from UBS Warburg (2003) and the Federal Communications Commission (2003d). UBS Warburg provides quarterly estimates of wholesale and retail access lines between the first quarter of 2000 and the third quarter of 2003 for the four major RBOCs in the USA (i.e. BellSouth, Qwest, SBC, and Verizon). The 2003 fourth quarter estimate is a predicted value. These data distinguish among UNE-L, UNE-P, and resale lines. The Federal Communications Commission provides estimates of CLEC-owned switched access lines semi-annually from December 1999 through June 2003. These estimates may well understate the actual number of facilities-based end-user switched access lines served by CLECs, in part because CLECs with fewer than 10,000 access lines are not required to report their activities to the Federal Communications Commission. The facilities estimates are voice-grade equivalents used to provide local voice telephone service (and are reported as such), not lines used to carry data. Voice telephone service is defined as local exchange or exchange access services that allow end-users to originate and/or terminate local telephone calls on the public switched network.
- 7 The wholesale discount is intended to reflect the avoided costs of certain retailing activities, including marketing, billing, collection, and other costs that will be avoided by the LEC (Federal Communications Commission, 1996, § 878). UNE prices are intended to reflect the long-run incremental cost an efficient ILEC would incur to produce the UNEs (see, for example, Laffont and Tirole, 2002; Mandy and Sharkey, 2003). Casual observation suggests the rate for wholesale services (i.e. resale) is roughly 20 percent less than retail services. (For example, the wholesale discount in New York is 19.1 percent with telephone company-provided operator services and 21.7 percent without these services.) In contrast, across all states (excluding Alaska), UNE-P prices averaged about \$18 per line as of July of 2003, while revenue per access line per month averaged about \$34. This \$15 difference is approximately 44 percent of average revenue.
- 8 Caution is warranted in interpreting this conclusion, though. Facilities-based CLEC activity is difficult to measure accurately, due to a lack of audited data. The estimated number of facilities-based CLEC access lines increased from 2.7 million to 6.3 million between the start of 2000 and the middle of 2003 (Federal Communications Commission, 2003d, table 3).
- 9 UBS Warburg (2003) provides data ON CLEC UNE-P, UNE-L, and resale lines by RBOC footprint. The estimates of CLEC facilities-based access lines in a particular RBOC footprint that appear in Figure 2 are based on national CLEC facilities-based lines as reported in Table 3 in (Federal Communications Commission, 2003d). To

- calculate facilities-based lines, the number of non-facilities CLEC lines in a RBOC footprint reported by UBS Warburg (2003) is multiplied by the national average of the ratio of CLEC facilities-based lines to CLEC non-facilities-based lines. This national average varies over time. Because the most recent Federal Communications Commission facilities data are for June 2003, national estimates of facilities for the last two quarters of 2003 are estimated using a simple time trend.
- 10 The retail price the RBOC charges is likely a reasonable proxy for the maximum price a CLEC can charge for local exchange service. The measure of potential profitability we employ is clearly a simple and crude one. It abstracts from many costs CLECs face and employs a limited measure of revenue potential. For example, the potential profitability measure does not include hot cut costs (i.e. the cost of physically disconnecting a customer loop from the ILEC switch and re-wiring it to the CLEC switch). See Krouse and Park (2003), for example, for an alternative measure of potential profitability.
 - 11 These revenue data are based on semi-annual estimates of average revenue per line (per month) in Table II in Gregg (2003) for the period April 2001 through July 2003. The July 2002, January 2003, and July 2003 data in Gregg (2003) are derived from Table 16.8 in Federal Communications Commission (2002d). The January 2002, July 2001, and April 2001 data in Gregg (2003) are based on Table 5 in Federal Communications Commission (2001b). The average revenue per line per month reported by Gregg (2003) is computed as the ILEC and subscriber line charge revenues per USF loop, both business and residential. The revenue values are end-user interstate and intrastate revenues.
 - 12 These average revenue per line per month values have at least two potential limitations. First, the values are reported for only two time periods, 1999 and 2000, although the cost data are reported for six time periods between April 2001 and July 2003. Second, the actual time period covered by the revenue values lags the cost data. For example, the revenue values Gregg (2003) reports for April 2001 through January 2002 reflect 1999 data as reported by the Federal Communications Commission in 2001. Also, the revenue values reported by Gregg (2003) for July 2002 through July 2003 reflect data from 2000 reported by the Federal Communications Commission in 2002. However, since CLEC activity is unlikely to respond immediately to changes in potential profit, the lagged nature of the revenue values may not be problematic. UBS Warburg (2003, chart 20) reports that average monthly revenue per voice grade equivalent line decreased between the first quarter of 2002 and the last quarter of 2003 by approximately \$2 for BellSouth and Verizon and approximately \$1 for SBC. Therefore our measure of potential profitability may overstate actual potential profitability.
 - 13 The UNE price data are based on Table 2 in Gregg (2003), which provides semi-annual data for the period April 2001 through July 2003. These data pertain to the wire centers of the major RBOC in each state. To derive a monthly per-line UNE price, per-minute switching rates are converted to dollars assuming 1,000 minutes per line. In states with per-call or set-up rates, 100 calls are assumed. In states with on-peak/off-peak switching rates, originating/terminating switching rates, or day/evening/night switching rates, the 1,000 minutes are allocated across these categories. See Gregg (2003) for details.
 - 14 The potential profitability in a RBOC footprint represents a weighted average of the potential profitability in the states in the footprint. The weights reflect the proportions of total access lines in the footprint accounted for by the individual states in the footprint.
 - 15 The maximum increase in measured average revenue was approximately 3 percent in the BellSouth footprint. For the other RBOCs, the increase in measured average revenue was approximately 1 percent.
 - 16 The CLEC switched access line variable reflects the semi-annual Federal Communications Commission data of end-user switched access lines served by RBOCs and other reporting local exchange carriers (LECs) for the periods: December 31, 2000 (Federal Communications Commission, 2001a); June 30, 2001 (Federal Communications Commission, 2002a); December 31, 2001 (Federal Communications Commission, 2002b); June 30, 2002 (Federal Communications Commission, 2002c); December 31, 2002 (Federal Communications Commission, 2003c); June 30, 2003 (Federal Communications Commission, 2003d). These data include resale, UNE-L, UNE-P, and facilities-based CLEC access lines. The December 2000 values are not employed in the regression, but are used to calculate the weights reflected in Figure 3.
 - 17 Population estimates are drawn from (US Census Bureau, Population Division, 2003). These estimates are reported for July of each year. Corresponding January estimates are computed as the average of preceding and succeeding July estimates.
 - 18 *Q* denotes Qwest, *S* denotes SBC, and *V* denotes Verizon. BellSouth is the omitted dummy variable in the regression, so the coefficients on *Q*, *S*, and *V* denote differences in CLEC activity relative to activity in the BellSouth footprint. The RBOC-specific dummy variable identifies the RBOC that operates in the state. Other LECs also may operate in the state.
 - 19 The time trend variable takes on the values 1, 2, 3, 4, and 5, for the time periods: June 30, 2001; December 31, 2001; June 30, 2002; December 31, 2002; and June 30, 2003, respectively.
 - 20 Relevant factors may include corporate philosophy and practice or regional political and regulatory factors, for example.
 - 21 Relevant factors may include interest rates, capital market constraints, and federal regulatory policy, for example.
 - 22 Our sample consists of 250 observations, reflecting activity in 49 states (not including Alaska) and the district of Columbia for the five time periods: June 30, 2001; December 31, 2001; June 30, 2002; December 31, 2002; and June 30, 2003.
 - 23 More formally, these estimates differ from zero with at least a 95 percent probability.
 - 24 The adjusted R^2 for the regression in equation (1) is 0.81, indicating that the regression explains approximately 81 percent of the variation in the data.
 - 25 Caution is warranted in interpreting this result because the measure of access lines employed in the regression counts both RBOC access lines and the access lines of other LECs. Using this measure, CLECs have the smallest fraction of access lines in the BellSouth footprint and the largest fraction of access lines in the Verizon footprint. In contrast, the only ILEC access lines considered in Figure 2 are RBOC access lines. Using this measure, CLECs have the smallest fraction of access lines in the Qwest footprint and the largest fraction of access lines in the SBC footprint.

- 26 The costs of providing local telephone service are predominantly loop costs (Abel and Witkind-Davis, 2000). UNE-L and UNE-P loop prices in an RBOC footprint are computed as a weighted average of the corresponding prices in the states in the footprint. The weights are the proportions of total access lines in the footprint accounted for by the individual states in the footprint. These semi-annual data cover the period July 1, 2001 through July 1, 2003, and are derived from Tables 1 and 2 in Gregg (2003). The access line data employed in the regression are drawn from UBS Warburg (2003). Our database consists of 20 observations reflecting access lines and prices for the four major RBOCs for five semi-annual time periods.
- 27 Equation (2) should be interpreted with considerable caution in part because there is little variation in relative UNE prices in our data. In addition, the variable reflecting relative UNE prices is the only explanatory variable in the regression and, although it is statistically significant, it is likely that other variables also influence the ratio of UNE-L to UNE-P access lines. Notice that the regression explains less than 22 percent of the variation in our sample (i.e. the adjusted R^2 is 0.217).
- 28 In a more complete analysis of the determinants of CLEC activity, the endogeneity of key explanatory variables (e.g. UNE prices) must be accounted for explicitly. (See Duso and Roller (2003), for example, for an illustration of the consequences of failing to account fully for the endogeneity of relevant variables.) A more complete analysis also should allow for alternative lag structures, since the most pronounced effects of regulated prices on CLEC activity may not arise immediately.
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